



The response of an invasive weed and its biological control agent under a changing climate of CO₂ enrichment: Management challenges for the future

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Parthenium weed (*Parthenium hysterophorus* L.) is an invasive weed of global significance that has become a major weed in Australia and many other parts of the world (Adkins and Shabbir 2014). Little information is available on the effects of CO₂ enrichment upon the weed's growth and the performance of one of its biological control agent, a stem galling moth (*Epiblema strenuana* Walker) used in the management of this weed. Therefore, any information on CO₂ enrichment responses will help develop better management strategies for this weed. The objective of the present study was to determine how much more effective (or otherwise) the biological control agent will be in managing parthenium weed when under CO₂ enrichment.

METHODOLOGY

Plants were grown in two growth chambers, one set at ambient (380 μmol/mol) and the other at elevated CO₂ (550 μmol/mol). When the plants were 6-weeks old, the stem galling moth larvae were removed from field collected galls and applied to half of the plants in each chamber, at a rate of two larvae per plant. The seed produced was counted and the proportion that was filled determined by x-ray analysis (Faxitron MX-20, Illinois, USA). After 110 days of growth, plant height, basal stem diameter, above ground biomass, number of branches, number of seeds and the leaf gas

exchange rate were determined (only the results for biomass and seed production described here).

RESULTS

Elevated CO₂ led to a significant increase (38%) in the weed's biomass production. The stem galling moth reduced the biomass production at both an ambient (36%) and elevated CO₂ (45%). More seeds (37%) were produced under elevated CO₂ (Plate 1). More branches (50%) were produced in response to stem-galling moth damage (data not shown), and this led to significantly more seeds per plant, however, a proportion (45%) were found not to be filled.

CONCLUSIONS

Elevated CO₂ has a profound positive effect upon both the growth and seed production of parthenium weed. The biological control agent had the ability to reduce the height and biomass of parthenium weed plants under both ambient and elevated CO₂ and these plants produced less seeds and seed fill. The biological control agent would remain effective in managing weed under climate change of CO₂ enrichment.

REFERENCE

Adkins S and Shabbir A. 2014. Biology, ecology and management of the invasive parthenium weed (*Parthenium hysterophorus* L.). *Pest Management Science* **70**(7): 1023-1029.